

# DIRECT USES

## District heating systems

Several Montana cities had district heating systems around the turn of the century. Large central plants sent steam through tunnels under the sidewalks to heat a number of buildings in downtown areas or on campuses. Today cities like Boise and Klamath Falls use geothermal water from wells instead of steam to heat groups of buildings. Montana cities like Baker and Poplar are considering district heating systems, and other towns have geothermal resources close by that could be used to heat groups of buildings.

## Greenhouses

Geothermal waters have long been used to extend growing seasons. Greenhouses often run warm water beneath the plant beds to stimulate growth, and also through the walls to heat the building. In Montana, this heat source could help greenhouse and aquaculture facilities more profitably provide locally grown food. Right now a commercial greenhouse near Butte uses their geothermal resource to produce tomatoes, and roses were once grown in geothermal greenhouses near Helena.



## Aquaculture

Aquaculture is growing things in water, whether it be fish or plants. Ponds near Boulder use geothermal water to grow fish, and other states grow tilapia, trout, sturgeon and alligators. Pond plants and algae are also grown with geothermal waters. Planning these facilities near geothermal resources can make the businesses more profitable.



MONTANA MEANS BUSINESS



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MONTANA MEANS BUSINESS

# MONTANA IS GEOTHERMAL COUNTRY



TAPPING A NATURAL HEAT SOURCE FOR TOMORROW'S POLLUTION-FREE ENERGY

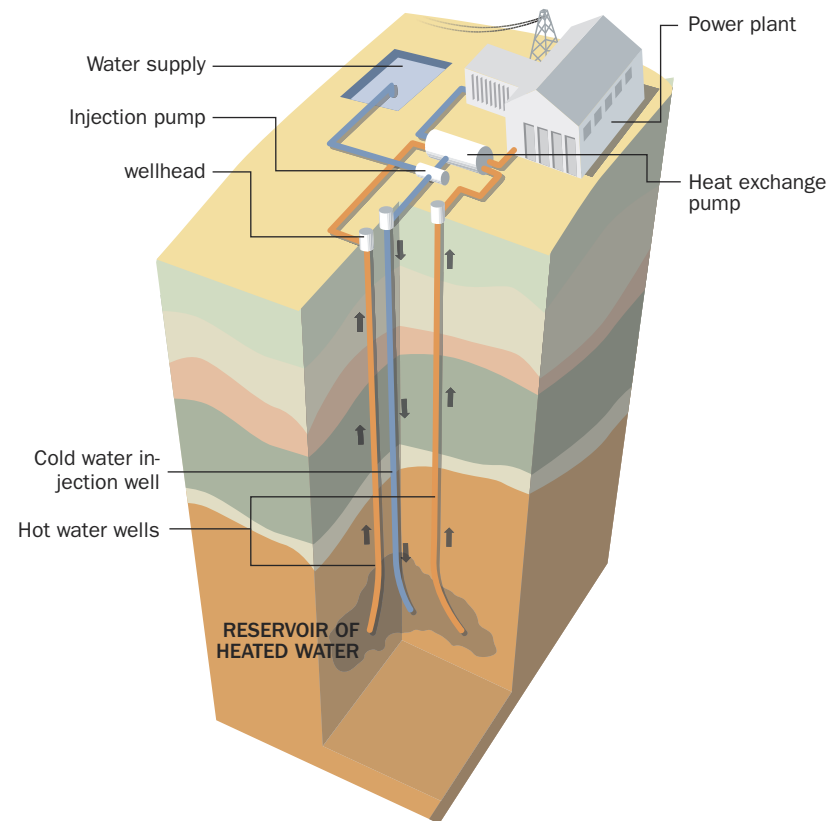


## WHAT IS GEOTHERMAL ENERGY?

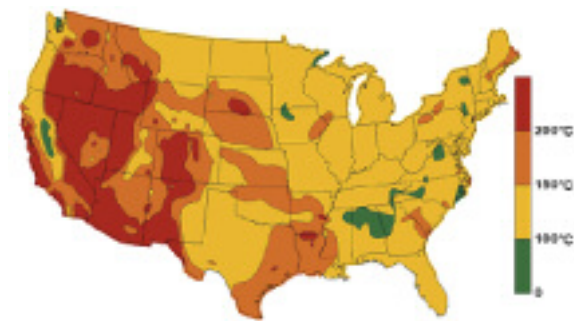
Geothermal energy is heat from the earth. Hot springs brought early residents to Montana as native peoples, trappers and traders spent cold winters near the comfort of warm waters bubbling to the surface. Today Montana's geothermal energy provides recreation, heat for buildings and greenhouses, and soon could provide clean, reliable electricity.

## ELECTRICITY GENERATION

Geothermal power plants bring hot water from deep wells through a heat exchanger, producing steam to drive a turbine. The water is returned to the earth. Once the power plant is built it produces a constant supply of electricity with no fuel costs and no emissions. These are base load power plants, providing clean, reliable energy with no fuel escalations.



While large scale power plants use water that is 300°F and higher, new technologies generate electricity at temperatures as low as 160°F. These turbines are suitable for distributed generation projects, where electricity is used on site rather than exported to the grid. Power plants are modular, with sizes as small as 250 kw.



## GEOTHERMAL ENERGY IN MONTANA

Industry stakeholders assert that Montana's geothermal resource has been overlooked due to the state's low fossil fuel energy prices, low population and lack of transmission access to remote locations. Also, some past geothermal projects were proposed for areas just outside Yellowstone National Park, which created local controversy and concerns. There are several direct use facilities currently in operation in Montana, mostly in western parts of the state, where geothermal heating is used for aquaculture (commercially-raised fish), greenhouses, and spas and resorts. The U.S. Department of Energy and the Montana state government have joined together to organize a database of locations where geothermal resources have been identified. According to their records, Montana has at least 15 high-temperature sites, a few of them with estimated deep-reservoir temperatures exceeding 350°F (176.7°C). Among these 15 sites are locations in the vicinity of Helena, Bozeman, Ennis, Butte, Boulder and White Sulphur Springs. There is also interest in oil and gas fields in Eastern Montana, including Poplar Dome, where oil wells co-produce hot fluid at boiling temperatures that may be sufficient to support a small geothermal power plant for use at the site. In the near term, oil and gas co-production and geothermal space heating is considered the greatest potential for using geothermal resources in Montana. State and federal support would help these projects come to fruition and encourage further investment in geothermal projects.



## GEOTHERMAL ENERGY FROM OIL AND GAS PRODUCTION

Oil and gas wells are typically thousands of feet deep, and often produce very hot fluid. Along with the fuels, most oil and gas wells produce quantities of water that have to be separated from the fuel. The waste water is usually reinjected deep below domestic aquifers. Some Montana oil and gas fields produce enough warm waste water to generate electricity.



The Rocky Mountain Oilfield Testing Center in Wyoming is demonstrating the use of warm waste fluids from oil and gas production to produce electricity. The electricity will be used on the site, so there is no power purchase agreement needed. It is considered distributed generation, and may be feasible for some Montana sites.

## ENGINEERED GEOTHERMAL SYSTEMS

Engineered geothermal systems, or EGS, are another way to partner with the oil and gas industry. Depleted oil and gas wells can accept waste water from producing wells to provide a working fluid for power production. Developers will look for sites with a combination of depleted and producing wells near transmission lines for large power plants. Research and development in this area is expected to make these projects economically feasible in the next twenty years, and demonstration projects could be sited in Montana sooner.



The Navy 1 geothermal power plant near Coso Hot Springs, California, is applying EGS technology. The Department of Energy estimates that the application of enhanced geothermal technology can more than double the amount of viable geothermal resources in the West.